

## Original Research Article

# Perception and practice of household solid waste management practices in rural Mysuru district: a cross-sectional study

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## ABSTRACT

**Background:** Effective household solid waste management (SWM) is vital for public health, environmental quality, and sustainable living. With rising global waste production, understanding current practices is essential for policy and system improvements. Objectives were to assess the practice and perception of household SWM among rural population

**Methods:** A community-based cross-sectional study was conducted in Suttur, Mysuru. Using systematic random sampling 200 households were selected. Data was collected using a validated, semi-structured questionnaire, including socio-demographic profiles, knowledge, and waste management practices. Analysis was performed using SPSS version 26 and chi-square tests were used to identify significant associations ( $p < 0.05$ ).

**Results:** Participants aged 18-30 years constituted 48% of the sample, with a nearly balanced gender distribution (49.5% male, 50.5% female). Waste segregation was practiced by 70% of households. Daily waste disposal was reported by 58.5% of participants, primarily using corporation dustbins (72%). Significant associations were found between awareness scores and age ( $p < 0.0001$ ), education level ( $p < 0.001$ ), type of house ( $p < 0.001$ ), socio-economic status ( $p = 0.007$ ), and marital status ( $p = 0.0001$ ). Graduates demonstrated the highest levels of excellent knowledge (43.2%), while illiterates had a significant proportion of poor knowledge (50%).

**Conclusions:** The study highlights the need for improved waste management systems, enhanced public awareness, and stricter regulations to address current environmental and health risks. Future research should focus on evaluating intervention effectiveness and exploring innovative waste management solutions in rural areas

**Keywords:** Household, SWM, Awareness, Waste segregation

## INTRODUCTION

Effective household waste management is a critical component of sustainable living, significantly impacting public health, environmental quality, and overall aesthetics. As the population grows, so does the complexity and volume of waste generated, necessitating a comprehensive understanding of current waste management practices to inform policy and improve systems.

Global waste production is escalating at a concerning pace. The world bank reported that in 2012, the world produced roughly 1.3 billion tons of solid municipal waste, with projections suggesting this figure could rise to 3.4 billion tons by 2030. According to the ministry of environment, forests, and climate change, India generates 62 million tons of waste annually, with an average yearly growth rate of 4%.<sup>1</sup>

On average, the composition of municipal solid waste (MSW) generated by Indian cities consists of

approximately 44% organic waste, which is compostable. The remaining 56% are non-compostable, with about 40% being inert materials and 16% comprising potentially recyclable materials. In India, the prevailing waste disposal practices and attitudes focus on simply discarding waste. Improper waste disposal leads to pollution and contaminates groundwater, harms local flora and fauna, spreads numerous diseases, and incurs significant environmental and economic costs.<sup>2</sup>

SWM poses a significant challenge for numerous local bodies in India. The processes of urbanization, industrialization, and economic growth have led to an increase in MSW generation per capita. The quest for sustainable development in a rapidly growing nation like India is complicated by its diverse array of religious groups, cultures, and traditions.<sup>3</sup>

Despite advancements in social, economic, and environmental spheres, SWM systems in India have seen only a little change. The informal sector plays a crucial role in reclaiming value from waste, with about 90% of residual waste being dumped rather than adequately landfilled. There is a pressing need to transition to more sustainable SWM practices.<sup>3</sup> Current SWM systems are inefficient and negatively impact public health, the environment, and the economy. Although the ministry of environment and forests (MoEF) introduced the waste management and handling rules in India, adherence to these regulations remains inconsistent and limited.<sup>4</sup>

Despite various initiatives by local authorities to address waste management, there remains a gap in understanding the effectiveness of these measures at the household level. This study aims to fill this gap by providing a detailed examination of household waste management practices in the rural area of the Mysuru district. This research seeks to identify prevailing behaviors, attitudes, and challenges related to waste disposal, segregation, and recycling among residents.

## METHODS

It is a community-based cross-sectional study done in Suttur, the rural field practice area of the department of community medicine, private medical college, Mysuru for three months and systematic random sampling was used. Study period was for 3 months July 1<sup>st</sup>-September 30, 2024.

Based on a previous study by Sudheera et al which shows 12.8% segregation of the waste by the population, the sample size calculated was calculated to be 171 which is approximated to be around 200 with a 20% nonresponse rate and 5% allowable error.<sup>5</sup>

Sample size was calculated using the formula  $n = \frac{z^2pq}{d^2}$

Sample size,  $n = (1.96)^2 \times 12.8 \times 87.2 / 5^2 = 171$

With a 20% non-response rate sample size was adjusted to approximately 200.

The study was started after obtaining the ethical committee's approval. The number of houses and village plan was obtained from the PHC. The village had 2175 houses for which line listing of the houses was done. The sampling frame was made, and the sampling interval was rounded to 13. So, every 13<sup>th</sup> house was taken for data collection. On non-availability or refusal, next consecutive house was taken.

## Inclusion criteria

Households with at least one member above 18 years of age located within the administrative boundary of Suttur village with domiciliary stability of about 1 year were included in study.

## Exclusion criteria

Households whose waste mixes with waste generated from commercial use (Shops, markets, salons, schools and clinics, etc.,) and industrial use were excluded.

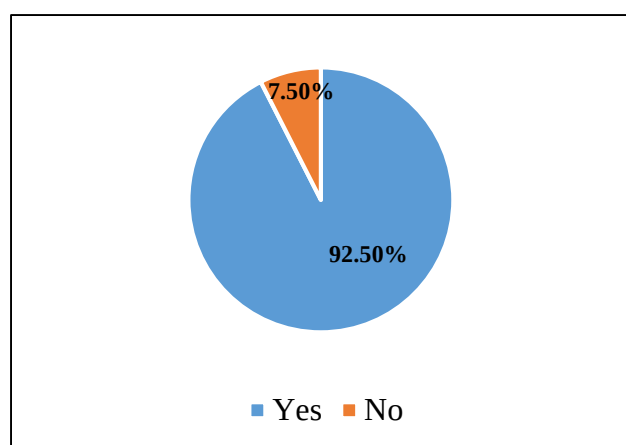
Data was collected using a pretested structured self-administered questionnaire. The questionnaire was divided into 3 parts. Part 1 includes a sociodemographic profile, part 2 includes questions regarding knowledge, and part 3 includes questions regarding the practice of household waste management. It was validated and pretested by subject experts and the reliability coefficient of the questionnaire was 0.732 based on the pilot study done on 30 households. The questions were assigned a score of 0 to 1 for inappropriate and right answers. Scores more than five were classified as excellent, scores between three and five as average, and scores below three as poor. The data collected was entered in a Microsoft excel 2019 spreadsheet followed by analysis using version 26.0 (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, version 26.0. Armonk, NY: IBM Corp). The percentage was calculated for descriptive variables. The chi-square test was applied to analyze qualitative data. Associations with  $p < 0.05$  at 95% CI were considered to be statistically significant

## RESULTS

Around 200 participants were present in the current study. The majority of participants were between 18-30 years old 96 (48%), followed by those aged 31-50 years 60 (30%), and above 50 years 44 (22%). The gender distribution was nearly balanced, with 49.5% male and 50.5% female participants. A significant proportion of participants were unskilled workers 65 (32.5%), followed by skilled workers 46 (23%). Smaller proportions were unemployed 15 (7.5%), semi-skilled workers 27 (13.5%), shop owners/farmers 28 (14%), semi-professionals 13 (6.5%), and professionals 6 (3%). The marital status distribution showed that 91 (45.5%) were unmarried,

90 (45%) were married, and 19 (9.5%) were widowed. Education levels varied, with the highest percentage being graduates 71 (35.5%). Other categories included illiterate 62 (31%), primary education 17 (8.5%), middle school 20 (10%), high school 15 (7.5%), and higher secondary education 15 (7.5%). The majority of participants were Hindu 191 (95.5%), with smaller proportions of Muslims 7 (3.5%) and Christians 2 (1%). Most participants lived in pucca houses 150 (75%), followed by semi-kuccha 35 (17.5%) and kuccha houses 15 (7.5%). Participants were distributed across different socio-economic classes: class III 60 (30%) had the highest representation, followed by class V 47 (23.5%), class II 42 (21%), class IV 37 (18.5%), and class I (7%) (Table 1).

In the current study, the majority around 185 (92.5%) practice cooking at home (Figure 1). The majority 172 (86%) cooks daily followed by 14 (7%) cooks thrice weekly at home.



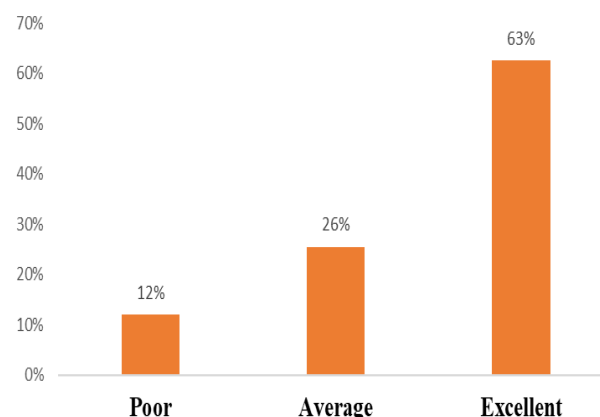
**Figure 1: Cooking practice at home among study participants.**

In the current study, regarding waste management practices at home, it is revealed that 140 participants (70%) segregate waste, while 60 (30%) do not. Most participants 136 (68%) carry their waste bins themselves, with a smaller number relying on children 7 (3.5%), paid collectors 36 (18%), and others 21 (10.5%). The types of waste disposed varied, with the largest group disposing of food waste and plastics 56 (28%), followed closely by those disposing of food waste, plastics, and bottles 55 (27.5%). Waste disposal frequency showed that 117 participants (58.5%) dispose waste daily, 50 (25%) more than once a week, and 33 (16.5%) once a week. The primary method of waste disposal was through corporation dustbins 144 (72%), with others opting for open fields 38 (19%) or burning 18 (9%) (Table 2).

In the current study, regarding perceptions of waste management, it was found that 158 participants (79%) believe there is an appropriate waste disposal site, while 42 (21%) do not. A vast majority, 186 participants 186

(93%), think waste management is important, compared to 14 (7%) who do not. Most participants, 97 (48.5%) feel that residents should make the residential area hygienic, followed by the community 39 (19.5%), the district council 27 (13.5%), the government 27 (13.5%), and private waste operators 10 (5%). Regarding disease occurrence from household waste, 122 participants (61%) perceived the spread of disease through household waste, 12 (6%) do not, and 66 (33%) were unsure. Knowledge and awareness about waste disposal were present in 149 participants (74.5%), while 51 (25.5%) lacked this awareness. Motivating factors for proper waste disposal include cleanliness for 88 participants (44%), cleanliness and fear of illness for 8 (4%), cleanliness, fear of illness, and odor for 48 (24%), and other combinations of factors for the remaining participants (Table 3).

In the current study, around 12% had poor knowledge, 26% had average knowledge whereas 63% had excellent knowledge regarding household waste management (Figure 2).



**Figure 2: Awareness score among study participants regarding household solid waste management.**

In the current study, age-wise, 9 (37.5%) 18-30 years had poor, 17 (33.33%) had average, and 70 (56%) had excellent awareness scores ( $p < 0.0001$ ) regarding household SWM. Education level showed that illiterate participants had 12 (50%) poor, 12 (23.53%) with average, and 38 (30.4%) with excellent scores, while graduates had 3 (12.5%) with poor, 14 (27.45%) with average, and 54 (43.2%) with excellent scores ( $p < 0.001$ ). Participants living in pucca houses showed 9 (37.5%) with poor, 34 (66.67%) with average, and 107 (85.6%) with excellent scores ( $p < 0.001$ ). Socio-economic status indicated that in class 1, 11 (45.8%) was poor, 15 (29.4%) had average, and 23 (18.4%) had excellent scores, while in class 3, 0 (0.0%) had poor, 15 (29.4%) had average, and 45 (36%) had excellent scores ( $p = 0.007$ ). Marital status showed significant differences with married participants having 12 (50.0%) with poor, 30 (58.82%) with average, and 48 (38.40%) with excellent scores ( $p = 0.0001$ ) (Table 4).

**Table 1: Socio-demographic profile of study participants, (n=200).**

| Socio-demographic variables |                     | N   | Percentage (%) |
|-----------------------------|---------------------|-----|----------------|
| Age (in years)              | 18-30               | 96  | 48             |
|                             | 31-50               | 60  | 30             |
|                             | >50                 | 44  | 22             |
| Gender                      | Male                | 99  | 49.5           |
|                             | Female              | 101 | 50.5           |
| Occupation                  | Unemployed          | 15  | 7.5            |
|                             | Unskilled worker    | 65  | 32.5           |
|                             | Semi-skilled worker | 27  | 13.5           |
|                             | Skilled worker      | 46  | 23             |
|                             | Shop owners/farmers | 28  | 14             |
|                             | Semi-professional   | 13  | 6.5            |
|                             | Professional        | 6   | 3.0            |
| Marital Status              | Married             | 90  | 45.0           |
|                             | Unmarried           | 91  | 45.5           |
|                             | Widowed             | 19  | 9.5            |
| Education                   | Illiterate          | 62  | 31.0           |
|                             | Primary             | 17  | 8.5            |
|                             | Middle school       | 20  | 10.0           |
|                             | High school         | 15  | 7.5            |
|                             | Higher secondary    | 15  | 7.5            |
|                             | Graduate            | 71  | 35.5           |
| Religion                    | Hindu               | 191 | 95.5           |
|                             | Christian           | 2   | 1.0            |
|                             | Muslim              | 7   | 3.5            |
| Type of house               | Kuccha              | 15  | 7.5            |
|                             | Pucca               | 150 | 75.0           |
|                             | Semi kuccha         | 35  | 17.5           |
| Socio-economic status       | Class I             | 14  | 7.0            |
|                             | Class II            | 42  | 21.0           |
|                             | Class III           | 60  | 30.0           |
|                             | Class IV            | 37  | 18.5           |
|                             | Class V             | 47  | 23.5           |

**Table 2: Household solid waste management practice at home.**

| Practice                        |                                       | N   | Percentage (%) |
|---------------------------------|---------------------------------------|-----|----------------|
| Is waste segregated at home     | Yes                                   | 140 | 70.0           |
|                                 | No                                    | 60  | 30.0           |
| Who carries waste bins at home? | Own self                              | 136 | 68.0           |
|                                 | Children                              | 7   | 3.5            |
|                                 | Paid collector                        | 36  | 18.0           |
|                                 | Others                                | 21  | 10.5           |
| Types of waste disposal at home | Food waste                            | 22  | 11.0           |
|                                 | Food waste, plastics                  | 56  | 28.0           |
|                                 | Food waste, plastics, bottles         | 55  | 27.5           |
|                                 | Food waste, plastics, bottles, others | 43  | 21.5           |
|                                 | Food waste, plastics, others          | 12  | 6.0            |
|                                 | Others                                | 8   | 4.0            |
|                                 | Plastics                              | 4   | 2.0            |
| Frequency of waste disposal     | Daily                                 | 117 | 58.5           |
|                                 | Once a week                           | 33  | 16.5           |
|                                 | More than once a week                 | 50  | 25.0           |
| How the wastes are disposed     | Burning                               | 18  | 9.0            |
|                                 | Corporation dustbin                   | 144 | 72.0           |
|                                 | Open field                            | 38  | 19.0           |

**Table 3: Awareness and perceptions regarding household solid waste management at home.**

| Perception                                                                         |                                             | N   | Percentage (%) |
|------------------------------------------------------------------------------------|---------------------------------------------|-----|----------------|
| <b>Respondent's perception of appropriate waste disposal site</b>                  | Yes                                         | 158 | 79.0           |
|                                                                                    | No                                          | 42  | 21.0           |
| <b>Is it important that waste should be managed?</b>                               | Important                                   | 186 | 93.0           |
|                                                                                    | Not important                               | 14  | 7.0            |
| <b>Who should make the residential area hygienic?</b>                              | Community                                   | 39  | 19.5           |
|                                                                                    | District council                            | 27  | 13.5           |
|                                                                                    | Government                                  | 27  | 13.5           |
|                                                                                    | Private waste operator                      | 10  | 5.0            |
|                                                                                    | Residents                                   | 97  | 48.5           |
| <b>What are your perceptions of disease occurrence in household waste</b>          | Yes                                         | 122 | 61.0           |
|                                                                                    | No                                          | 12  | 6.0            |
|                                                                                    | Don't know                                  | 66  | 33.0           |
| <b>Do you have knowledge and awareness regarding waste disposal?</b>               | Yes                                         | 149 | 74.5           |
|                                                                                    | No                                          | 51  | 25.5           |
| <b>Element that motivates the household occupants to dispose of waste properly</b> | Cleanliness                                 | 88  | 44.0           |
|                                                                                    | Cleanliness, fear of illness                | 8   | 4.0            |
|                                                                                    | Cleanliness, fear of illness, odour         | 48  | 24.0           |
|                                                                                    | Cleanliness, fear of illness, odour, others | 22  | 11.0           |
|                                                                                    | Cleanliness, odour                          | 9   | 4.5            |
|                                                                                    | Cleanliness, odour, others                  | 2   | 1.0            |
|                                                                                    | Fear of illness                             | 6   | 3.0            |
|                                                                                    | Odor                                        | 17  | 8.5            |

**Table 4: Association of socio-demographic profile and awareness score regarding household solid waste management study participant.**

| Socio-demographic variables |                      | Awareness score, n (%) |            |            | Chi-square | P value |
|-----------------------------|----------------------|------------------------|------------|------------|------------|---------|
|                             |                      | Poor                   | Average    | Excellent  |            |         |
| <b>Age (in years)</b>       | 18-30                | 9 (37.5)               | 17 (33.33) | 70 (56)    | 24.521     | <0.0001 |
|                             | 31-50                | 3 (12.5)               | 17 (33.33) | 40 (32)    |            |         |
|                             | >50                  | 12 (50)                | 17 (33.33) | 15 (32)    |            |         |
| <b>Gender</b>               | Male                 | 11 (45.83)             | 19 (37.25) | 69 (55.2)  | 4.813      | 0.09    |
|                             | Female               | 13 (54.6)              | 32 (62.7)  | 56 (44.8)  |            |         |
| <b>Occupation</b>           | Unemployed           | 3 (12.5)               | 4 (7.8)    | 8 (6.4)    | 24.993     | 0.015   |
|                             | Unskilled worker     | 7 (29.2)               | 21 (41.2)  | 37 (29.6)  |            |         |
|                             | Semi-skilled worker  | 3 (12.5)               | 24 (19.2)  | 0 (0.00)   |            |         |
|                             | Skilled worker       | 3 (12.5)               | 13 (25.5)  | 30 (24)    |            |         |
|                             | Shop owners/ farmers | 8 (33.33)              | 8 (15.7)   | 12 (9.6)   |            |         |
|                             | Semi-professional    | 0 (0.00)               | 3 (5.9)    | 10 (8)     |            |         |
| <b>Marital status</b>       | Professional         | 0 (0.00)               | 2 (3.9)    | 4 (3.2)    | 22.80      | 0.0001  |
|                             | Married              | 12(50.0)               | 30 (58.82) | 48 (38.40) |            |         |
|                             | Unmarried            | 6 (25.0)               | 14 (27.45) | 71 (56.80) |            |         |
| <b>Education</b>            | Widowed              | 6 (25.0)               | 7 (13.73)  | 6 (4.80)   | 55.202     | <0.001  |
|                             | Illiterate           | 12(50)                 | 12 (23.53) | 38 (30.4)  |            |         |
|                             | Primary              | 6 (25)                 | 11 (21.57) | 0 (0.00)   |            |         |
|                             | Middle school        | 0 (0.00)               | 8 (15.69)  | 12 (9.6)   |            |         |
|                             | High school          | 3 (12.5)               | 6 (11.76)  | 6 (4.80)   |            |         |
|                             | Higher secondary     | 0 (0.00)               | 0 (0.00)   | 15 (12)    |            |         |
| <b>Religion</b>             | Graduate             | 3 (12.5)               | 14 (27.45) | 54 (43.2)  | 9.343      | 0.05    |
|                             | Hindu                | 24 (100)               | 46 (90.2)  | 121 (96.8) |            |         |
|                             | Christian            | 0 (0.00)               | 0 (0.00)   | 2 (1.6)    |            |         |
|                             | Muslim               | 0 (0.00)               | 5 (9.8)    | 2 (1.6)    |            |         |

Continued.



| Socio-demographic variables |             | Awareness score, n (%) |            |            | Chi-square | P value |
|-----------------------------|-------------|------------------------|------------|------------|------------|---------|
|                             |             | Poor                   | Average    | Excellent  |            |         |
| Type of house               | Kuccha      | 6 (25)                 | 3 (5.88)   | 6 (4.8)    | 30.867     | <0.001  |
|                             | Pucca       | 9 (37.5)               | 34 (66.67) | 107 (85.6) |            |         |
|                             | Semi kuccha | 9 (37.5)               | 14 (27.45) | 12 (9.60)  |            |         |
| Socio-economic status       | Class 1     | 11 (45.8)              | 15 (29.4)  | 23 (18.4)  | 21.22      | 0.007   |
|                             | Class 2     | 3 (12.5)               | 9 (17.6)   | 30 (24)    |            |         |
|                             | Class 3     | 0 (0.0)                | 15 (29.4)  | 45 (36)    |            |         |
|                             | Class 4     | 7 (29.2)               | 10 (19.6)  | 20 (16)    |            |         |
|                             | Class 5     | 3 (12.5)               | 2 (3.9)    | 7 (5.6)    |            |         |

## DISCUSSION

The rate of waste generation is influenced by various factors such as population density, economic status, commercial activity, cultural practices, and regional characteristics. Higher population density typically correlates with increased waste production, while economic status influences both the types and quantities of waste generated. Areas with more commercial activity tend to produce higher volumes of waste, and cultural norms significantly shape waste management practices. Additionally, geographic and demographic features play pivotal roles in determining overall waste generation rates.<sup>3</sup> Our study revealed that 72% of households utilize corporation dustbins for waste disposal, while 19% dispose of waste in open fields, and 9% resort to burning, highlighting a mix of organized collection and significant environmental risks associated with improper disposal practices. Similarly, Sudheera et al found nearly equal reliance on municipal services (47.9%) and open dumping (45.3%) in rural Puducherry, India, underscoring the urgent need for improved waste management infrastructure.<sup>5</sup> Furthermore, 54.7% of households in our study use the public drainage system for sullage, raising concerns about potential water pollution.<sup>5</sup> Additionally, 54.7% of households use the public drainage system for sullage, raising concerns about potential water pollution.<sup>5</sup> Comparing socio-demographic data with findings from Fadhullah et al revealed interesting insights regarding age-related waste segregation practices and knowledge levels. Our study indicated that the 18-30 age group exhibits a high percentage (56%) of excellent knowledge about waste segregation, whereas the >50 age group shows a lower percentage (32%).<sup>6</sup> Conversely, Fadhullah et al reported that individuals aged 50-65 are most diligent in segregating waste, suggesting that knowledge alone may not guarantee better waste segregation practices, implicating other influencing factors such as motivation or resources.<sup>6</sup> Our study finds that graduates have the highest percentage of excellent knowledge (43.2%), while illiterates show a significant percentage of poor knowledge (50%).<sup>7</sup> Primary education shows no excellent knowledge, indicating that higher educational attainment correlates with better knowledge of SWM. In comparison to our study a similar study was conducted by Shatnawi et al reported that over 80% of students lack knowledge about SWM, and 60% are unaware of the health and

environmental impacts of improper waste handling.<sup>7</sup> Shatnawi et al highlighted significant gaps in student knowledge about SWM and its environmental impacts, underscoring the critical need for comprehensive education and awareness initiatives across all educational levels.<sup>7</sup>

Our study also found that 70.0% of households practice waste segregation at home, with waste management primarily handled by household members (68.0%), followed by paid collectors (18.0%), children (3.5%), and others (10.5%). A study conducted by Donacho et al reported that 21.5% of households engage in waste sorting at the point of generation, with 78.5% not practicing sorting, yet 59.3% recover useful resources from waste.<sup>8</sup> Moreover, access to door-to-door private waste collectors was limited to 29.2%, while 63.6% of households had waste collection containers within their compounds.<sup>8</sup>

In terms of waste disposal practices, our study categorized prevalent behaviors, with food waste alone constituting 11.0% of cases. The most common practices included combinations of food waste and plastics (28.0%), followed closely by food waste, plastics, and bottles (27.5%). Elmosaad et al similarly noted that plastic waste constituted the highest percentage (45.5%), followed by paper (15.4%), glass (12.9%), food waste (10.1%), textiles (8.6%), and battery and electronic waste (3.9%).<sup>9</sup> These findings underscore the variability in household waste disposal methods and emphasize the need for tailored waste management strategies.

The study's limitations include its focus on a single rural area, reliance on self-reported data prone to bias, a cross-sectional design that limits causal inferences, and the influence of contextual and cultural factors on participant responses.

## CONCLUSION

Our findings highlight the imperative for enhanced waste management systems, increased public awareness, and stricter regulations to mitigate the environmental and health risks associated with current practices. Future research should focus on evaluating the effectiveness of

these interventions and exploring innovative solutions to address rural waste management challenges.

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